WHAT IS CLAIMED IS:

1. A method for gasification of a carbonaceous material to a substantially nitrogen-free product gas, comprising the steps of:

providing a source of oxygen-enriched gas containing less than about 20 mole percent nitrogen;

providing a source of water vapor;

pre-mixing said oxygen-enriched gas and water vapor to form a substantially homogeneous mixture;

contacting said substantially homogeneous mixture with a substantially ash-free carbonaceous fuel at substantially stoichiometric ratio in a high turbulence burner having one of an aerodynamic and a bluff body flame holder to promote the formation of free radical species of the combustion products at an adiabatic flame temperature exceeding about 2400°C (1316°C);

wherein an ultra-superheated steam (USS) composition is produced comprising a mixture of superheated water vapor, carbon dioxide and free radicals with less than about 3.0 mole percent free oxygen;

recovering and directing said ultra-superheated steam (USS) composition to a gasification reactor wherein a carbonaceous material is reacted with said ultra-superheated steam (USS) composition to form a product gas.

2. A method in accordance with claim 1, wherein said oxygen-enriched gas comprises at least about 80 mole percent oxygen.

3. A method in accordance with claim 1, wherein the homogeneous mixture of steam and oxygen-enriched gas comprises about 15 to about 40 mole percent oxygen.

4. A method in accordance with claim 1, wherein said carbonaceous fuel burned in said burner comprises at least one of a liquid petroleum product, gaseous hydrocarbon fuel, and a produced fuel gas.

5. A method in accordance with claim 1, wherein said carbonaceous fuel burned in said burner comprises product gas produced in said gasification reactor.

6. A method in accordance with claim 1, wherein the

quantity of oxygen in said substantially homogeneous mixture is substantially stoichiometric with respect to the quantity of substantially ash-free fuel.

7. A method in accordance with claim 1, wherein at least one of said water vapor and oxygen is pre-heated prior to contact with said carbonaceous material.

8. A method in accordance with claim 1, wherein said ultra-superheated steam (USS) composition has a temperature of about 2400°F (1316°C) to about 5000°F (2760°C).

9. A method in accordance with claim 1, wherein said ultra-superheated steam (USS) is essentially clear and colorless.

10. A method in accordance with claim 1, wherein said carbonaceous material is gasified at a reactor temperature of about 1200°F (649°C) to about 2200°F (1204°C).

11. A method in accordance with claim 1, wherein said carbonaceous material comprises one of coal, coke,

biomass, liquid petroleum fraction, liquid cracking product, gaseous hydrocarbon and a refinery waste material.

12. A method in accordance with claim 1, wherein said produced fuel gas is substantially nitrogen-free.

13. A method in accordance with claim 1, wherein said carbonaceous material gasified by said ultrasuperheated steam comprises a mixture of a first carbonaceous material containing substantially no oxygen with a second carbonaceous material containing substantial oxygen.

14. A method in accordance with claim 13, wherein said first carbonaceous material comprises less than about 10 w/w % oxygen, and said second carbonaceous material comprises at least about 20 w/w % oxygen.

15. A method in accordance with claim 13, wherein said quantity of said second carbonaceous material to be mixed with said first carbonaceous material is determined by:

(a) initiating and maintaining gasification in at least

one ratio of second carbonaceous material to said first carbonaceous material;

(b) determining the carbon dioxide content of the outlet gas at each ratio of second carbonaceous material to said first carbonaceous material;

(c) comparing each determined carbon dioxide content with a minimum controllable positive preset value thereof; and

(d) iterating steps (a) through (c) with increasing ratios of said second carbonaceous material to said first carbonaceous material until said desired minimum controllable positive preset value of carbon dioxide content is substantially attained.

16. A method in accordance with claim 15, wherein said ratio of second carbonaceous material to said first carbonaceous material is adjusted to maintain a continuous gasification process at substantially said minimum controllable positive preset value of carbon dioxide content in said product gas.

17. A method in accordance with claim 15, wherein the mole percent of carbon dioxide in said product gas is

maintained at a value less than about 1-10 mole percent.

18. A method in accordance with claim 13, wherein said quantity of said second carbonaceous material to be mixed with said first carbonaceous material is determined by:

(a) initiating and maintaining gasification in at least one ratio of second carbonaceous material to said first carbonaceous material;

(b) determining the free water content of the outlet gas at each ratio of second carbonaceous material to said first carbonaceous material;

(c) comparing each determined free water content with a minimum controllable positive preset value thereof; and

(d) iterating steps (a) through (c) with increasing ratios of said second carbonaceous material to said first carbonaceous material until said minimum controllable positive preset value of free water content is substantially attained.

19. A method in accordance with claim 18, wherein said ratio of second carbonaceous material to said first

carbonaceous material is adjusted to maintain a continuous gasification process at substantially said minimum controllable positive preset value of free water content in said product gas.

20. A method in accordance with claim 18, wherein the mole percent of free water in said product gas is maintained at a value less than about 1-10 mole percent.

21. A method in accordance with claim 13, wherein said first carbonaceous material comprises one of coal and a hydrocarbon.

22. A method in accordance with claim 13, wherein said second carbonaceous material comprises a cellulosic material.

23. A method in accordance with claim 13, wherein the first carbonaceous material comprises coal at about 85 w/w % to about 98 w/w % concentration, and the second carbonaceous material comprises a cellulosic material at about 2 w/w percent to about 15 w/w percent concentration.

24. A method in accordance with claim 13, wherein the first carbonaceous material comprises coal at about 10 w/w % to about 60 w/w % concentration, and the second carbonaceous material comprises a cellulosic material at about 40 w/w percent to about 90 w/w percent concentration.

25. A method for producing an ultra-superheated steam composition, comprising the steps of:

providing a source of oxygen-enriched gas;

providing a source of water vapor;

pre-mixing said oxygen-enriched gas and water vapor from said sources to form a substantially homogeneous mixture; and

contacting said substantially homogeneous mixture with a substantially ash-free fuel in a high turbulence burner with one of an aerodynamic and bluff body flame holder to promote the formation of free radical species of burner combustion products at an adiabatic flame temperature of at least about 2400°F (1316°C);

whereby an ultra-superheated steam composition is produced in said burner comprising a mixture of superheated water vapor, carbon dioxide and free

radicals with less than about 3.0 mole percent free oxygen;

wherein said ultra-superheated steam composition has a temperature of at least about 2400°F (1316°C).

26. A method in accordance with claim 25, wherein said oxygen-enriched gas comprises at least about 80 mole percent oxygen.

27. A method in accordance with claim 25, wherein the homogeneous mixture of steam and oxygen-enriched gas comprises about 15 to about 40 mole percent oxygen.

28. A method in accordance with claim 25, wherein the substantially ash-free fuel comprises one of a petroleum-based liquid, hydrocarbon containing gas, and a produced fuel gas from a gasification process.

29. A method in accordance with claim 25, wherein the quantity of oxygen in said substantially homogeneous mixture is substantially stoichiometric with respect to the quantity of substantially ash-free fuel.

30. A method in accordance with claim 25, wherein at least

one of said water vapor and oxygen is pre-heated prior to contacting with said substantially ash-free fuel.

31. A method in accordance with claim 25, wherein the ultra-superheated steam (USS) is produced at an adiabatic flame temperature of between about 2400°F (1316°C) and about 5000°F (2760°C).

32. A method in accordance with claim 25, wherein the ultra-superheated steam is produced in a clear colorless flame.

33. A method in accordance with claim 25, wherein said produced fuel gas is substantially nitrogen-free.

34. A method in accordance with claim 25, further comprising the step of collecting and directing said ultra-superheated steam (USS) to an industrial process.

35. A method in accordance with claim 34, wherein said industrial process comprises a gasification process in which a carbonaceous material is converted to a fuel gas containing substantially CO and H_2.

36. A method in accordance with claim 35, wherein said substantially ash-free fuel comprises a portion of the fuel gas produced by said gasification process.

37. In a gasification apparatus for gasifying a carbonaceous material to a product gas with an ultra-superheated steam (USS) composition in a reactor, the ultra-superheated steam formed in a high turbulence burner with an aerodynamic flame holder at an adiabatic flame temperature of between about 2400°F (1316°C) and about 5000°F (2760°C) by combustion of a substantially ash-free fuel with a pre-mixture of oxygen and water vapor; wherein a method for controlling the temperature of the gasification product gas comprises:

controlling the ratio of (a) oxygen in said pre-mixture to (b) said carbonaceous fuel fed to the burner at a near-stoichiometric value to limit free oxygen in the ultra-superheated steam composition to a value generally less than about 3.0 mole percent; and

controlling the rate of oxygen and substantially ash-free fuel in said pre-mixture, whereby the temperature of said product gas is controlled at a preset temperature between about 1200°F (649°C)

and about 2200°F (1204°C).

38. In a gasification apparatus for gasifying a carbonaceous material to a product gas with an ultra-superheated steam (USS) composition in a reactor, the ultra-superheated steam formed in a high turbulence burner with an aerodynamic flame holder at a an adiabatic flame temperature of between about 2400°F (1316°C) and about 5000°F (2760°C) by combustion of a substantially ash-free carbonaceous fuel with a pre-mixture of oxygen and water vapor; wherein a method for controlling the temperature of the gasification product gas comprises:

controlling the ratio of (a) oxygen in said pre-mixture to (b) said carbonaceous fuel fed to the burner at a near-stoichiometric value to limit free oxygen in the ultra-superheated steam composition at a value generally less than about 3.0 mole percent;

controlling the rate of ultra-superheated steam composition at a substantially constant value; and

controlling the rate of carbonaceous material fed to said gasification reactor to control the temperature of said product gas at a preset temperature between about 1200°F (649°C) and about

2200°F (1204°C).

39. A method for increasing the efficiency of a thermal gasification of a first carbonaceous material substantially comprising elemental carbon in a gasification reactor, said method comprising the steps of:

determining a quantity of a second carbonaceous material containing oxygen to be combined with said first carbonaceous material for optimal gasification; and

combining said determined quantity of said second carbonaceous material with said first carbonaceous material; and

gasifying said combined first carbonaceous material and second carbonaceous material containing oxygen in said reactor to produce a product gas.

40. A method in accordance with claim 39, wherein said quantity of said second carbonaceous material to be combined with said first carbonaceous material is determined by:

(a) initiating and maintaining gasification in at least one ratio of second carbonaceous material to said

first carbonaceous material to produce a product gas;

(b) determining the carbon dioxide content of the reactor outlet gas at each ratio of said second carbonaceous material to said first carbonaceous material;

(c) predetermining a desirable controllable minimally positive value of carbon dioxide in said reactor outlet gas;

(d) comparing each determined carbon dioxide content with said predetermined minimally positive value of carbon dioxide; and

(e) iterating steps (a) through (c) with increasing ratios of said second carbonaceous material to said first carbonaceous material until said predetermined controllable minimally positive value is substantially attained.

41. A method in accordance with claim 40, wherein the desired quantity of second carbonaceous material added to said first carbonaceous material at said predetermined controllable minimally positive value of carbon dioxide is between about 5 percent and about 25 percent by weight.

42. A method for increasing the efficiency of a thermal gasification of a second carbonaceous material containing substantial oxygen in a gasification reactor, comprising the steps of:

determining a quantity of a first carbonaceous material substantially comprising elemental carbon to be combined with said second carbonaceous material for optimal gasification; and

gasifying said quantity of second carbonaceous material and said first carbonaceous material in said reactor.

43. A method in accordance with claim 42, wherein said quantity of first carbonaceous material to be combined with said second carbonaceous material is determined by:

(a) initiating and maintaining gasification in at least one ratio of first carbonaceous material to said second carbonaceous material;

(b) determining the carbon dioxide content of the reactor outlet gas at each ratio of first carbonaceous material to said second carbonaceous material;

(c) predetermining a desirable controllable minimally positive value of carbon dioxide in said reactor outlet gas;

(d) comparing each determined carbon dioxide content with said predetermined minimally positive value of carbon dioxide; and

(e) iterating steps (a) through (c) with increasing ratios of said first carbonaceous material to said second carbonaceous material until said predetermined controllable minimally positive value is substantially attained.

44. A method in accordance with claim 43, wherein the desired quantity of first carbonaceous material added to said second carbonaceous material at said predetermined controllable minimally positive value of carbon dioxide is between about 5 percent and about 50 percent by weight.

45. A method for reducing oxygen consumption per unit produced fuel gas in an oxygen-blown gasification process gasifying a first carbonaceous material substantially comprising elemental carbon to a substantially nitrogen-free product gas, said method

comprising:

adding a second carbonaceous material substantially comprising cellulose to said first carbonaceous material at about 5 w/w percent to about 25 w/w percent thereof; and

gasifying the mixture of elemental carbon and cellulosic material at an elevated temperature.

46. A method for reducing oxygen consumption per unit produced fuel gas in an oxygen-blown gasification process gasifying a first carbonaceous material containing cellulose to a substantially nitrogen-free product gas, said method comprising:

adding a second carbonaceous material substantially comprising elemental carbon to said first carbonaceous material at about 5 w/w percent to about 50 w/w percent; and

gasifying the mixture of elemental carbon and cellulosic material at an elevated temperature.